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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/766,646	01/27/2004	Heon Lee	200300380-1	4583

22879 7590 09/19/2005

HEWLETT PACKARD COMPANY
P O BOX 272400, 3404 E. HARMONY ROAD
INTELLECTUAL PROPERTY ADMINISTRATION
FORT COLLINS, CO 80527-2400

EXAMINER

CHEN, ERIC BRICE

ART UNIT	PAPER NUMBER
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1765

DATE MAILED: 09/19/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/766,646	LEE, HEON	
	Examiner	Art Unit	
	Eric B. Chen	1765	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 27 January 2004.
- 2a) ☐ This action is FINAL. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-18 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-18 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 1/27/04 is/are: a) ☐ accepted or b) ☒ objected to by the Examiner.
 Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
 Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | Paper No(s)/Mail Date. _____ |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| Paper No(s)/Mail Date <u>1/27/04</u> . | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Priority

1. Applicant is advised of possible benefits under 35 U.S.C. 119(a)-(d), wherein an application for patent filed in the United States may be entitled to the benefit of the filing date of a prior application filed in a foreign country.

Drawings

2. The drawings are objected to because Figure 7 (reference characters "70" and "84") and Figure 8 (reference character "94") contain misspellings. Corrected drawing sheets in compliance with 37 CFR 1.121(d) are required in reply to the Office action to avoid abandonment of the application. Any amended replacement drawing sheet should include all of the figures appearing on the immediate prior version of the sheet, even if only one figure is being amended. The figure or figure number of an amended drawing should not be labeled as "amended." If a drawing figure is to be canceled, the appropriate figure must be removed from the replacement sheet, and where necessary, the remaining figures must be renumbered and appropriate changes made to the brief description of the several views of the drawings for consistency. Additional replacement sheets may be necessary to show the renumbering of the remaining figures. Each drawing sheet submitted after the filing date of an application must be labeled in the top margin as either "Replacement Sheet" or "New Sheet" pursuant to 37 CFR 1.121(d). If the changes are not accepted by the examiner, the applicant will be notified and

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informed of any required corrective action in the next Office action. The objection to the drawings will not be held in abeyance.

Claim Rejections - 35 USC § 103

3. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

4. This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

5. Claims 1-2, 4-5, 10-11, and 13-14 are rejected under 35 U.S.C. 103(a) as being unpatentable over Mehregany et al. (U.S. Patent No. 6,136,243), in view of Chou (U.S. Patent No. 6,309,580), in further view of Chang (U.S. Patent Appl. Pub. No. 2002/0137331), in further view of Applicant's admitted Prior Art.

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6. As to claim 1, Mehregany discloses method of fabricating a silicon carbide structure (column 2, lines 5-7), comprising: patterning a mold layer (200) (column 4, lines 56-64); etching the mold layer (200) to form a cavity (204) in the mold layer (200); depositing a material comprising silicon carbide in the cavity to form a feature positioned in the cavity and a foundation layer connected with the feature (column 5, lines 18-24; Figure 1A); planarizing the foundation layer to form a substantially planar surface (column 5, lines 24-30); and extracting the silicon carbide imprint stamp by releasing the feature and the foundation layer from the mold layer (column 5, lines 30-34). Because Mehregany discloses forming cavity (204) with a standard photolithographic process (column 4, lines 61-63), there is a strong presumption that that first feature size that is greater than or equal to a lithography limit (Figure 2B).

7. Mehregany does not expressly disclose that the silicon carbide structure is an imprint stamp. Chou teaches a method of imprint lithography, including use of a molding layer (14) (column 7, lines 50-51; Figure 1A) (or imprint stamp) formed from silicon carbide (column 6, lines 59-66) using vapor deposition molding (column 7, lines 1-5). Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to form an imprint stamp using Mehregany's method, because Chou teaches that imprint stamps are formed of silicon carbide using vapor deposition molding.

8. In addition, Mehregany does not expressly disclose depositing a spacer layer on the mold layer, the spacer layer conformally covering a surface of the cavity; and forming a spacer in the cavity by anisotropically etching the spacer layer so that the

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spacer is connected with a portion of the surface of the cavity and the spacer partially fills the cavity so that the cavity includes a second feature size that is less than the lithography limit. However, Mehregany's method is directed at forming molds in silicon substrates (column 3, lines 51-54), including the use of masking layers, dry etching, and lithography techniques (column 1, lines 12-16). Chang discloses a method of forming cavities with a reduced dimension (paragraph 0002) in silicon (paragraph 0003), including depositing a spacer layer (130) on the substrate layer (120), the spacer layer conformally covering a surface of the cavity (150) (paragraph 0028; Figure 7); and forming a spacer (140A/140B) in the cavity (150) by anisotropically etching the spacer layer so that the spacer is connected with a portion of the surface of the cavity (150) and the spacer partially fills the cavity (150) (paragraph 0028; Figure 8) so that the cavity includes a second feature size that is less than the lithography limit (paragraph 0029). Moreover, Chang's method produces features with dimensions that are not limited by the resolution of lithographic techniques (paragraph 0029). Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to deposit a spacer layer on the mold layer, the spacer layer conformally covering a surface of the cavity; and form a spacer in the cavity by anisotropically etching the spacer layer so that the spacer is connected with a portion of the surface of the cavity and the spacer partially fills the cavity so that the cavity includes a second feature size that is less than the lithography limit. Moreover, it would have been obvious to one of ordinary skill in the art at the time the invention was made to deposit a material comprising silicon carbide on the spacer and at least a portion of the feature includes

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the second feature size. One who is skilled in the art would be motivated to form features in silicon that are less than the resolution achieved by lithographic techniques.

9. In addition, Mehregany does not expressly disclose bonding a handling substrate with the foundation layer by applying heat and pressure to the handling substrate and the mold layer until the handling substrate and the foundation layer form a mechanical bond with each other. However, Applicant's admitted Prior Art discloses a method of forming an imprint stamp (200), including bonding handling substrate (207) with the foundation layer (203) by applying heat and pressure to the handling substrate and the mold layer until the handling substrate and the foundation layer form a mechanical bond with each other (Specification, page 2, paragraph 2; Figures 3A-3B, 4A-4B). Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to bond a handling substrate with the foundation layer by applying heat and pressure to the handling substrate and the mold layer until the handling substrate and the foundation layer form a mechanical bond with each other, because Applicant teaches that this method is useful in forming an imprint stamp.

10. As to claim 2, Applicant's admitted Prior Art discloses that the releasing comprises a grinding a backside surface of the mold layer (201) until the mold layer is released from the feature (203F) and the foundation layer (203) (Specification, page 2 paragraph 3; Figures 5A-5B).

11. As to claim 4, Applicant's admitted Prior Art discloses etching a remainder of the mold layer to effectuate the releasing of the feature and the foundation layer (Specification, page 2 paragraph 3; Figures 5A-5B). In addition, Mehregany discloses

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etching a remainder of the mold layer to effectuate the releasing of the feature and the foundation layer (column 5, lines 25-34). Moreover, it would have been obvious to one of ordinary skill in the art at the time the invention was made to etch the spacer layer in order to achieve a feature smaller than the resolution of lithography.

12. As to claim 5, Mehregany discloses that the surface of the cavity (204) includes a bottom surface and a sidewall surface (Figure 2C-2D). Chang discloses that the surface of the cavity (150) includes a bottom surface and a sidewall surface and the spacer (140A/140B) is connected with the sidewall surface of the cavity (paragraph 0028; Figure 8).

13. As to claim 10, Mehregany discloses method of fabricating a silicon carbide structure (column 2, lines 5-7), comprising: patterning a mold layer (200) (column 4, lines 56-64); etching the mold layer (200) to form a cavity (204) in the mold layer (200); depositing a material comprising silicon carbide in the cavity to form a feature positioned in the cavity and a foundation layer connected with the feature and at least a portion of the feature includes the second feature size (column 5, lines 18-24; Figure 1A); planarizing the foundation layer to form a substantially planar surface (column 5, lines 24-30); and extracting the silicon carbide imprint stamp by releasing the feature and the foundation layer from the mold layer (column 5, lines 30-34). Because Mehregany discloses forming cavity (204) with a standard photolithographic process (column 4, lines 61-63), there is a strong presumption that that first feature size that is greater than or equal to a lithography limit (Figure 2B).

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14. Mehregany does not expressly disclose that the silicon carbide structure is an imprint stamp. Chou teaches a method of imprint lithography, including use of a molding layer (14) (column 7, lines 50-51; Figure 1A) (or imprint stamp) formed from silicon carbide (column 6, lines 59-66) using vapor deposition molding (column 7, lines 1-5). Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to form an imprint stamp using Mehregany's method, because Chou teaches that imprint stamps are formed of silicon carbide using vapor deposition molding.

15. In addition, Mehregany does not expressly disclose depositing a spacer layer on the mold layer, the spacer layer conformally covering a surface of the cavity; and forming a spacer in the cavity by anisotropically etching the spacer layer so that the spacer is connected with a portion of the surface of the cavity and the spacer partially fills the cavity so that the cavity includes a second feature size that is less than the lithography limit. However, Mehregany's method is directed at forming molds in silicon substrates (column 3, lines 51-54), including the use of masking layers, dry etching, and lithography techniques (column 1, lines 12-16). Chang discloses a method of forming cavities with a reduced dimension (paragraph 0002) in silicon (paragraph 0003), including depositing a spacer layer (130) on the substrate layer (120), the spacer layer conformally covering a surface of the cavity (150) (paragraph 0028; Figure 7); and forming a spacer (140A/140B) in the cavity (150) by anisotropically etching the spacer layer so that the spacer is connected with a portion of the surface of the cavity (150) and the spacer partially fills the cavity (150) (paragraph 0028; Figure 8) so that the

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cavity includes a second feature size that is less than the lithography limit (paragraph 0029). Moreover, Chang's method produces features with dimensions that are not limited by the resolution of lithographic techniques (paragraph 0029). Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to deposit a spacer layer on the mold layer, the spacer layer conformally covering a surface of the cavity; and form a spacer in the cavity by anisotropically etching the spacer layer so that the spacer is connected with a portion of the surface of the cavity and the spacer partially fills the cavity so that the cavity includes a second feature size that is less than the lithography limit. Moreover, it would have been obvious to one of ordinary skill in the art at the time the invention was made to deposit a material comprising silicon carbide on the spacer and at least a portion of the feature includes the second feature size. One who is skilled in the art would be motivated to form features in silicon that are less than the resolution achieved by lithographic techniques.

16. In addition, Mehregany does not expressly disclose depositing a glue layer on the substantially planar surface of the foundation layer; and bonding a handling substrate with the glue layer by applying pressure and heat to the handling substrate and the mold layer until the glue layer forms a mechanical bond with the foundation layer and the handling substrate. However, Applicant's admitted Prior Art discloses a method of forming an imprint stamp (200), including depositing a glue layer (205) on the substantially planar surface (203S) of the foundation layer (203); bonding a handling substrate (207) with the glue layer by applying pressure and heat to the handling substrate and the mold layer until the glue layer forms a mechanical bond with the

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foundation layer and the handling substrate (Specification, page 2, paragraph 2; Figures 3A-3B, 4A-4B). Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to deposit a glue layer on the substantially planar surface of the foundation layer; and bond a handling substrate with the glue layer by applying pressure and heat to the handling substrate and the mold layer until the glue layer forms a mechanical bond with the foundation layer and the handling substrate, because Applicant teaches that this method is useful in forming an imprint stamp.

17. As to claim 11, Applicant's admitted Prior Art discloses that the releasing comprises a grinding a backside surface of the mold layer (201) until the mold layer is released from the feature (203F) and the foundation layer (203) (Specification, page 2 paragraph 3; Figures 5A-5B).

18. As to claim 13, Applicant's admitted Prior Art discloses etching a remainder of the mold layer to effectuate the releasing of the feature and the foundation layer (Specification, page 2 paragraph 3; Figures 5A-5B). In addition, Mehregany discloses etching a remainder of the mold layer to effectuate the releasing of the feature and the foundation layer (column 5, lines 25-34). Moreover, it would have been obvious to one of ordinary skill in the art at the time the invention was made to etch the spacer layer in order to achieve a feature smaller than the resolution of lithography.

19. As to claim 14, Mehregany discloses that the surface of the cavity (204) includes a bottom surface and a sidewall surface (Figure 2C-2D). Chang discloses that the surface of the cavity (150) includes a bottom surface and a sidewall surface and the

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spacer (140A/140B) is connected with the sidewall surface of the cavity (paragraph 0028; Figure 8).

20. Claims 3 and 12 are rejected under 35 U.S.C. 103(a) as being unpatentable over Mehregany, in view of Chou, in further view of Chang, in further view of Applicant's admitted Prior Art, in further view of Wolf, *Silicon Processing for the VLSI Era*, Vol. 4, Lattice Press (2002).

21. As to claims 3 and 12, Mehregany does not expressly disclose that the grinding comprises a chemical mechanical planarization process. Wolf teaches that chemical mechanical polishing (or chemical mechanical planarization) is a well-recognized planarization technology, appropriate for polishing both conductor and dielectric materials, and is capable of achieving planarization on a global scale (page 313). Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to use a chemical mechanical planarization process. One who is skilled in the art would be motivated to use a well-recognized planarization technology, appropriate for polishing both conductor and dielectric materials, and capable of achieving planarization on a global scale.

22. Claims 6-7 and 15-16 are rejected under 35 U.S.C. 103(a) as being unpatentable over Mehregany, in view of Chou, in further view of Chang, in further view of Applicant's admitted Prior Art, in further view of Jeong et al. (U.S. Patent No. 6,943,117).

23. As to claims 6 and 15, Mehregany does not expressly disclose that after the extracting, forming a master imprint stamp by mounting a plurality of the silicon carbide imprint stamps to a master substrate. However, Jeong discloses a method of imprint

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lithography (column 1, lines 10-14), including forming a master imprint stamp (40) by mounting a plurality of imprint stamps (41) to a master substrate (column 8, lines 45-59; Figure 6). Jeong teaches that it is more effective to imprint features on a large substrate with a features formed on single stamp as large as the substrate (column 2, lines 22-30) because only a single imprinting step is performed, which eliminates the need to repeated realign the stamp as in the step and repeat imprinting process (column 2, lines 14-20). Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to form a master imprint stamp by mounting a plurality of the silicon carbide imprint stamps to a master substrate. One who is skilled in the art would be motivated to more effectively imprint features on a large substrate.

24. As to claim 7 and 16, Mehregany does not expressly disclose positioning a plurality of the silicon carbide imprint stamps in an array of rows and columns on the master substrate. However, Jeong discloses a method of imprint lithography (column 1, lines 10-14), including positioning a plurality of imprint stamps in an array of rows and columns on the master substrate (column 10, lines 31-37; Figure 18). Jeong teaches that such an arrangement maximizes the utilization of a large substrate (column 10, lines 35-37). Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to position a plurality of the silicon carbide imprint stamps in an array of rows and columns on the master substrate. One who is skilled in the art would be motivated to more effectively imprint features on a large substrate and to select an arrangement to maximize utilization of a large substrate.

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25. Claims 8-9 and 17-18 are rejected under 35 U.S.C. 103(a) as being unpatentable over Mehregany, in view of Chou, in further view of Chang, in further view of Applicant's admitted Prior Art, in further view of Rossnagel et al., *Handbook of Plasma Processing*, Noyes Publications (1990).

26. As to claims 8 and 17, Mehregany does not expressly disclose that the forming the spacer comprises a reactive ion etching of the spacer layer. Chang discloses that forming the spacer (140A/140B) comprises anisotropically etching of the spacer layer (130) (paragraph 0028). Rossnagel teaches that reaction ion etching is anisotropic and is a commonly used etching method to form features in silicon (page 198-199).

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to form the spacer comprising a reactive ion etching of the spacer layer. One who is skilled in the art would be motivated to use a conventional silicon etching method.

27. As to claims 9 and 18, Mehregany does not expressly disclose that the etching the mold layer comprises an anisotropic reactive ion etching of the mold layer to form the cavity. Rossnagel teaches that reaction ion etching is anisotropic and is a commonly used etching method to form features in silicon (page 198-199). Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to etch the mold layer comprising an anisotropic reactive ion etching of the mold layer to form the cavity. One who is skilled in the art would be motivated to use a conventional silicon etching method.

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Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Eric B. Chen whose telephone number is (571) 272-2947. The examiner can normally be reached on Monday through Friday, 8AM to 4:30PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nadine G. Norton can be reached on (571) 272-1465. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

EBC
Sept. 15, 2005

NADINE G. NORTON
SUPERVISORY PATENT EXAMINER